

### Amendments to the claims

Claim 1. (Currently amended) An integrated optical ~~router~~ switching device, comprising:

a substrate;

a plurality  $K$  of first arrayed waveguide gratings formed in said substrate and configured as optical demultiplexers each including at least one first input and  $W$  first outputs;

a plurality  $K$  of second arrayed waveguide gratings formed in said substrate and configured as optical multiplexers each including at least  $W$  second inputs and one second output;

a third arrayed waveguide grating formed in said substrate and having  $WK$  third inputs and  $WK$  third outputs;

a plurality  $WK$  of first wavelength converters at least partially formed in said substrate between respective ones of said first outputs and said third inputs and converting a wavelength of a first optical input signal while maintaining it in optical form; and

a plurality  $WK$  of second wavelength converters at least partially formed in said substrate between respective ones of said third outputs and said second inputs and converting a wavelength of a second optical input signal while maintaining it in optical form.

Claim 2. (Currently amended) The optical ~~router~~ switching device of Claim 1, wherein said substrate includes an InP base and semiconductor layers epitaxially formed thereover.

Claim 3. (Currently amended) The optical ~~router~~ switching device of Claim 1, wherein said first and second wavelength converters each include [[a]] an electronically modulated Mach-Zehnder interferometer including active regions formed in said substrate.

Claim 4. (Currently amended)

The optical ~~router~~ switching device of Claim 1, wherein said substrate is bonded to a

single thermoelectric cooler.

Claim 5. (Currently amended) The optical ~~router~~ switching device of Claim 3, wherein said first and second wavelength converters each include a tunable laser.

Claim 6. (Currently amended) The optical ~~router~~ switching device of Claim 5, wherein said tunable lasers are formed in said substrate.

Claim 7. (Currently amended)

The optical ~~router~~ switching device of Claim 3, further comprising at least one electronic chip bonded to said substrate and electrically connected to said active regions and said active regions.

Claim 8. (Previously presented ) An optical router, comprising:

a plurality  $K$  of optical splitters wavelength dividing a received optical signal into a first splitter port for wavelengths within a first silica fiber band and into a second splitter port for wavelengths within a different second silica fiber band;

a plurality  $K$  of optical detectors receiving and detecting optical signals from respective ones of said first splitter ports;

a plurality  $K$  of first arrayed waveguide gratings each including a first input port receiving optical signals from respective ones of said second splitter ports and further including at least  $W$  first output ports;

a second arrayed waveguide grating including  $WK$  second input ports optically connected to respective ones of said first output ports and further including  $WK$  second output ports;

a plurality  $K$  of third arrayed waveguide gratings each including  $W$  third input ports optically connected to respective ones of said second output ports and further including a third output port;

a plurality  $K$  of lasers emitting light at a wavelength within said first silica fiber band; and

a plurality  $K$  of optical combiners and each having a first combiner input port receiving

radiation from a respective one of said lasers and a second combiner input port connected to respective ones of said third output ports and further including an combiner output port output radiation received on said first and second combiner input ports.

Claim 9. (Original) The router of Claim 8, further comprising:

$WK$  tunable first wavelength converters disposed between respective pairs of said first output ports and said second input ports; and

$WK$  tunable second wavelength converters disposed between respective pairs of said second output ports and said third input ports.

Claim 10. (Original) The router of Claim 9, further comprising a substrate in which said dividers, said combiners, and said first, second and third arrayed waveguides are formed.

Claims 11 – 23. (Canceled)

Claim 24. (Currently amended) An optical router, comprising:

~~a plurality  $K$  of first arrayed waveguide gratings formed in said substrate and configured as optical demultiplexers each including at least one first input and  $W$  first outputs;~~

~~a plurality  $K$  of second arrayed waveguide gratings formed in said substrate and configured as optical multiplexers each including at least  $W$  second inputs and one second outputs;~~

~~a third arrayed waveguide grating formed in said substrate and having  $WK$  third inputs and  $WK$  third outputs;~~

~~a plurality  $WK$  of first wavelength converters at least partially formed in said substrate between respective ones of said first outputs and said third inputs; and~~

~~a plurality  $WK$  of second wavelength converters at least partially formed in said substrate between respective ones of said third outputs and said second inputs.~~

a plurality  $K$  of first arrayed waveguide gratings arranged in sectors in a first substrate and wavelength selectively connecting a respective first input port to a plurality of respective

first output ports;

a plurality  $K$  of opto-electronic circuitries arranged in said sectors each receiving optical inputs from said first output ports of a respective one ~~[[ones]]~~ of said first arrayed waveguide gratings and including at least one control electrode;

a second arrayed waveguide grating receiving optical inputs from all of said opto-electronic circuitries; and

a plurality of electronic control circuits formed in respective second substrates, bonded to said first substrate ~~substrates~~ within respective ones of said sectors and connected to respective ones of said control electrodes.

Claim 25. (Currently amended) The router of Claim 24, wherein said first substrate comprises an InP base and said second ~~substrate comprises a~~ substrates comprise GaAs [base] bases.

Claim 26. (Original) The router of Claim 25, further comprising an electronic silicon circuit bonded to said first substrate and connected to all of said electronic control circuits

Claim 27. (Currently amended) An optical router, comprising:

a substrate;

a plurality  $K$  optical demultiplexers comprising first arrayed waveguide gratings formed in said substrate and each including at least one first input and  $W$  first outputs, wherein  $W$  is greater than one;

a plurality  $K$  optical multiplexers comprising second arrayed waveguide gratings formed in said substrate and each including at least  $W$  second inputs and one second output;

a wavelength router comprising a third arrayed waveguide grating formed in said substrate and having  $WK$  third inputs and  $WK$  third outputs;

a plurality  $WK$  of first wavelength converters connected between respective ones of said first outputs and said third inputs; and

a plurality  $WK$  of second wavelength converters connected between respective ones of

said third outputs and said second inputs.

Claim 28. (Canceled)

Claim 29. (Currently amended) The router of Claim [28] 27, wherein said first and second wavelength converters are at least partially formed in said substrate.

Claim 30. (New) The switching device of Claim 1, wherein said first wavelength converters can change a wavelength in less than 450ns.

Claim 31. (New) The switching device of Claim 1, wherein said first wavelength converters operate in response to information contained in a packet to thereby switch said packet through said third arrayed waveguide grating.

Claim 32. (New)) An integrated optical switching device, comprising:

a substrate;

a plurality  $K$  of first arrayed waveguide gratings formed in said substrate and configured as optical demultiplexers each including at least one first input and  $W$  first outputs;

a plurality  $K$  of second arrayed waveguide gratings formed in said substrate and configured as optical multiplexers each including at least  $W$  second inputs and one second output;

a third arrayed waveguide grating formed in said substrate and having  $WK$  third inputs and  $WK$  third outputs;

a plurality  $WK$  of first wavelength converters at least partially formed in said substrate between respective ones of said first outputs and said third inputs; and

a plurality  $WK$  of second wavelength converters at least partially formed in said substrate between respective ones of said third outputs and said second inputs.

Claim 33. (New) The optical switching device of Claim 32, said substrate is bonded to a

single thermoelectric cooler.

Claim 34. (New) An integrated optical switching device, comprising:  
a first substrate including an InP base and having formed therein  
a plurality of first arrayed waveguide gratings,  
a plurality of second arrayed waveguide gratings,  
a third arrayed waveguide array grating disposed physically and operatively  
between (1) said first array waveguide gratings and (2) said second array waveguide gratings,  
and  
a plurality of opto-electronic portions disposed physically and operatively  
between said (1) third waveguide grating and (2) said first and second waveguide gratings;  
at least one second substrate each including a GaAs base bonded to said first substrate  
and including first electrical circuitry electrically contacted to said opto-electronic portions; and  
an integrated circuit including a silicon base bonded to said at least one second substrate  
and including second electrical circuitry controlling said first electrical circuitry.

Claim 35. (New) The optical switching device of Claim 35, wherein said at least one second substrate includes a plurality of second substrates electrically contacted to respective ones of said opto-electronic portions.

Claim 36. (New) The router of Claim 8, further comprising a substrate in which said dividers, said combiners, and said first and second arrayed waveguides are formed.